

Chapter 7

Recommendations

7.0 Recommendations

Virginia's energy path forward will require actions by each of us individually, in our businesses and industries, and by our government institutions. The recommendations set out actions that will help secure Virginia's energy future and implement the energy policy and objectives set out as the Energy Policy of the Commonwealth, Chapter 1 of Title 67 of the Code of Virginia (see Appendix B).

Virginia must overcome market, consumer-education, historical energy-cost, public-policy, and institutional barriers to meet these energy policies and objectives. Overcoming these barriers will require a mix of public and private investments in energy actions.

This Plan sets a goal to increase energy independence in Virginia with an emphasis on conservation and efficiency and clean-fuel technologies.

- Expanded conservation and efficiency actions aim to reduce by 40 percent the rate of growth in energy use that Virginia would see without the Plan's recommended actions (base case). This will require a concerted effort in implementing new actions to reduce use of electric, natural gas, and petroleum products. The Plan's energy-savings goal is based on the following:
 - Virginia has set its goal to reduce electric use by 10 percent of 2006 electric use by 2022 through energy-efficiency, conservation, and demand-management activities. This would reduce our electric demand by nearly 3,900 megawatts, equivalent to four times the capacity of the proposed Virginia City Hybrid Energy Center. This would reduce Virginians' electric costs by \$200 to \$700 million through 2022 (net savings after cost of measures). Total savings over the life of measures would total between \$300 and \$590 million for each yearly investment in energy-efficiency measures
 - Natural gas use in Virginia can be reduced more than 7 percent through the cost-effective, achievable strategies identified in this Plan. This would reduce Virginians' natural gas costs by more than \$125 million per year (net savings after cost of measures).
- Consumption of petroleum products used to heat our homes and businesses can be reduced 10 percent through the actions identified in this Plan. Transportation fuel use can be cut 5 percent through the recommendations in this Plan.
- The 40 percent conservation goal of this Plan also includes weatherizing an additional 700 homes of low-income Virginia families per year through increased investment in the Weatherization Assistance Program.
- Virginia utilities will need to make substantial investments in new energy production and infrastructure. This Plan sets the goal to increase in-state generation of energy by 20 percent over what is projected in the 2017 base case.
 - To meet this goal and maintain the same rate of electricity imported into Virginia as was imported in 2006 (even after meeting the 10% electric savings goal), Virginia must expand its electric generation infrastructure by more than 2,300 megawatts. This should include Virginia's electric utilities making full progress toward meeting the 12 percent renewable energy supply goal provided for in the state's new renewable portfolio standard. Virginia electric utilities also will need to construct new electric transmission infrastructure to deliver needed electricity to growing market areas. Proposed new plants include the 585-megawatt coal- and biomass-fired Virginia City Hybrid Energy Center, the 520-megawatt natural gas-fired power plant in Warren County, and the 300-megawatt natural gas peak power plant expansion in Caroline County. (See Chapter 4 for more information on infrastructure.)
- Virginia's natural gas utilities will need to make ongoing investments in new infrastructure to deliver needed natural gas to consumers. This includes constructing a third

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pipeline across the James River between north and south Hampton Roads and constructing new local distribution pipelines and peak storage facilities. Other pipeline and peak storage projects will be needed in growing areas such as northern Virginia.

- Virginia will need to invest in new transportation fuel infrastructure. The energy generation goals in this Plan include increasing the capacity of the petroleum refinery in Yorktown by 40,000 barrels per day and providing 300 million gallons per year of ethanol production and 120 million gallons per year of biodiesel production.
- Consumers must be educated about energy opportunities if we are to overcome the consumer knowledge market barriers. With clear knowledge, consumers will be comfortable in taking energy-saving actions and making energy-savings investments. Changing consumer behavior and creating demand for energy services and products can have the largest impact on our ability to meet our energy goals. Virginia must expand the delivery of energy-efficiency and demand-control information to its citizens to meet this Plan's consumer education goal.
- Virginia also must reduce greenhouse gas emissions. This Plan sets a goal to reduce greenhouse gas emissions back to 2000 levels by 2025. This will require 2005 levels to be 30 percent lower than projected levels with no action.
- Implementing the energy-efficiency and renewable-energy recommendations of this Plan will allow Virginia to meet a goal of reducing its greenhouse gas emissions by approximately 15 percent, or 18 million metric tons per year.
- Energy-efficiency and conservation actions alone will not be sufficient to reach this goal. Therefore, Virginia should establish a Commission on Climate Change to make a comprehensive assessment of greenhouse gas issues and develop a plan for how Virginia can reach this greenhouse gas emission

reduction goal.

- Virginia should provide long-term support for energy research and development (R&D) to foster long-term improvements in how Virginia and the nation produce and use energy. This Plan sets out the goal to increase energy R&D by \$10 million per year from state, private, and federal resources. Without this investment, Virginia will be unable to attract federal and private investment in energy R&D and the state's businesses will be left behind in the world marketplaces in which they compete.
- The General Assembly enacted energy business incentives such as the Biofuels Incentive Grant and the Solar Photovoltaic Manufacturing Incentive Grant programs. Virginia must invest in these incentives if they are to be effective in bringing these energy-based jobs to the state. Virginia needs to support existing businesses wishing to make substantial new investments in energy activities, such as around the nuclear business cluster in Lynchburg. Start-up financial support is needed if Virginia is to be the home of businesses that bring new energy technologies to the marketplace and develop new innovative energy sources and infrastructure. These will provide a basis for new job growth and income to the Commonwealth.
- There are opportunities for smaller-scale energy projects that can prove the viability of leading-edge technologies, creating new opportunities for consumers and Virginia businesses.

The Commonwealth should ensure that these activities are effective in meeting Virginia's energy goals. The Governor's Energy Policy Advisory Council, with assistance from the Department of Mines, Minerals and Energy and other state agencies, should evaluate the energy saved, new supplies of energy generated, and value of investments in energy R&D and new business development. The results of the evaluation should be reported to the Governor and the General Assembly to ensure accountability of the proposed energy activities.

Through these efforts, Virginia will increase the role of energy efficiency and

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conservation, support existing businesses with reliable low-cost energy supplies, support new job growth, increase energy-education activities, increase energy assistance to low-income Virginians, and increase energy R&D at our universities and businesses. Virginians will see lower energy costs in the short term because of efficiency and conservation actions, and have a more secure energy future because of investments in new energy infrastructure, energy R&D, and new energy businesses.

7.1 Energy Efficiency and Conservation

Energy efficiency and conservation is the first area where we should take actions for a secure energy future.

As described in the 2006 National Action Plan for Energy Efficiency, energy efficiency and conservation can:

- Lower consumers' energy bills.
- Give consumers greater control over energy-use decisions.

- Cost less than developing many types of new energy sources.
- Be deployed in smaller increments and more quickly than large supply projects.
- Reduce the environmental impact of expanding energy use.
- Support economic development through jobs delivering energy conservation services and decreasing export of funds outside Virginia for energy imports.
- Reduce the level of energy imports, lessening the vulnerability of our economy to price and supply disruptions.

This Plan sets out a goal to reduce future growth in energy use by 40 percent below what would happen without the recommendations of this Plan (see Figure 7-1). This would reverse Virginia's per capita energy consumption growth rate and provide for nearly level per capita energy use per year by the end of the term of this Plan (see Figure 7-2).

Figure 7-1 Virginia Total Energy Consumption Trends

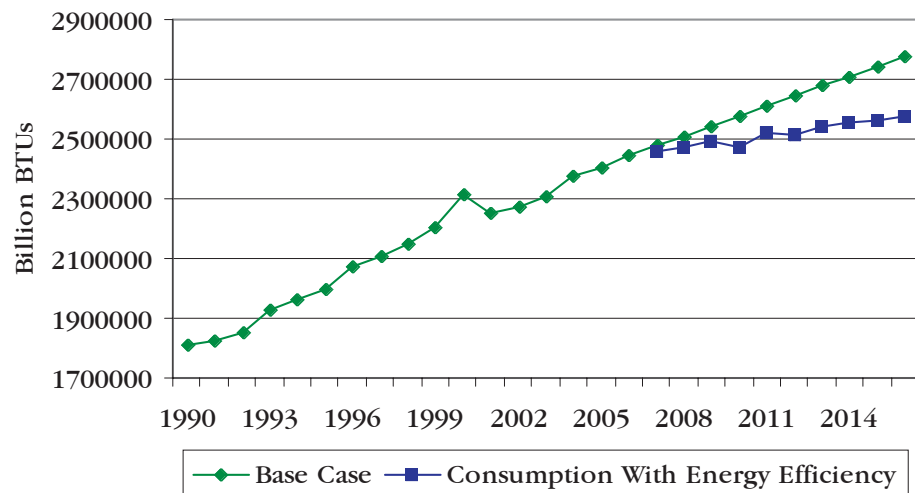
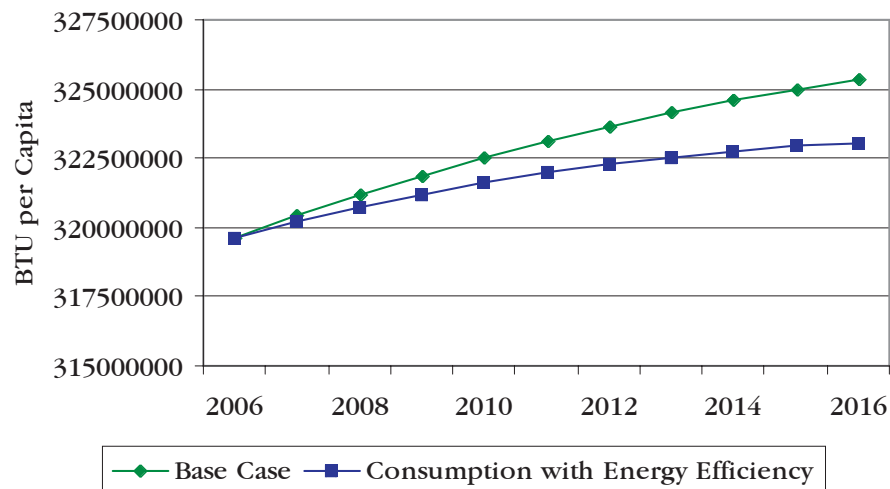


Figure 7-2 Virginia Per Capita Energy Consumption Trends



7.1.1 State Policies for Energy Efficiency and Conservation

With increasing energy costs and public attention to energy issues, Virginia has the opportunity to set state government policies and implement programs that will increase the use of energy conservation strategies in the state.

Consumer Energy Efficiency

Virginia should, contingent on an acceptable revenue impact, expand its sales-tax holiday to include energy-savings natural gas, fuel oil, and propane-fueled equipment. Virginia established the October sales-tax holiday for Energy Star electrically powered equipment. There are substantial efficiency and conservation improvements available with other types of equipment. Expanding the sales-tax holiday to these types of equipment will offer the savings to consumers using other than electric equipment.

Virginia should also consider adding a spring sales-tax holiday for Energy Star and other high-efficiency equipment. This will offer the sales-tax holiday at the time that consumers are making decisions about air conditioning and other types of equipment not on the market during the

fall sales-tax holiday. A spring sales-tax holiday will help Virginia reduce its summer electric demand peak and overall electricity costs.

The Commonwealth should also work with equipment and product suppliers, retailers, and utilities to publicize the Energy Star tax holiday and promote the Energy Conservation Awareness Week.

While having a larger revenue impact, Virginia could provide tax incentives for energy efficiency and conservation similar to those provided by the federal government for investments such as energy-efficiency building improvements, high-efficiency equipment, combined heat and power installations, heat recovery, and other technologies. These would include tax credits and accelerated depreciation for investments in energy efficiency and conservation.

Utility Conservation Programs

Virginia has an opportunity to reduce its electric consumption over the next ten years. Analysis provided for this Plan shows that Virginia should be able to cost effectively achieve a 14 percent reduction in electric energy use. The General Assembly established a goal that 10 percent of electric use by retail customers

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(2006 base year) should be offset by conservation and efficiency by 2022. It directed the State Corporation Commission (SCC) to convene a proceeding to determine if the 10 percent goal can be cost effectively achieved, to identify the mix of programs to be used to achieve the goal, and to develop an implementation plan that identifies the entities that could most effectively implement the programs and that estimates the cost of attaining the goal.

These activities can be undertaken by utilities or by governmental and non-governmental stakeholders. The final mix of types of activities, costs, and providers should be determined through the 2007 SCC proceeding on electric utility conservation programs.

Analysis completed for this Plan shows that Virginia electric utilities would have to invest in the range of \$100 to \$120 million per year between 2008 and 2022 to meet the 10 percent electric savings goal. This would have to be matched by \$180 to \$200 million per year by electric consumers.

These investments would lead to increased total costs to electric consumers over the first seven years, followed by savings over the next eight years until 2022. Total net consumers savings would be between \$200 and \$700 million after paying for the investments. Total savings over the lives of the measures would range from \$300 to \$590 million for each yearly investment in energy-efficiency measures.

Energy-efficiency and conservation activities should address all customer classes and income levels. This will minimize the risk of cross-subsidization among customer groups. A broad spectrum of stakeholders, including utilities, consumers, and environmental interest groups, should actively participate in the SCC's energy-efficiency proceeding.

Proposed utility-based energy-conservation activities should be assessed for cost effectiveness. There are several tools available to assess cost effectiveness of the programs. They include the Total Resource Cost Test, Societal Test,

Utility/Program Administrator Test, Participant Test, and Rate Impact Measure Test. A measure of the cost per kilowatt hour of conserved energy also may be used to evaluate activities. Each evaluative tool will measure a component of cost effectiveness. Utility energy-efficiency and conservation activities should be measured using the full set of evaluative tools. No single energy-efficiency program assessment tool should be used solely as a go-no go decision mechanism.

After being implemented, utility energy-efficiency and conservation activities should be evaluated for effectiveness through use of measurement and verification protocols. Standardized measurement and verification protocols that have been used in other states should be used in Virginia. Programs not meeting planned results should be reevaluated to determine if they should be modified or ended. This evaluation should be completed on an annual basis.

Virginia's electric energy conservation portfolio should include programs that have proven successful in other states. Specific utility actions found to be effective in other states include:

- Promotion of the Energy Star sales-tax holiday.
- Residential and non-residential energy assessments to help consumers identify how to use energy efficiently.
- Provision of real-time rates and advanced metering for customers with the ability to control electric use in peak demand periods. This could include the ability to aggregate demand among customers to participate in the PJM demand-response program.
- Financial incentives for replacing old, less efficient appliances and equipment with high-efficiency models (including documentation of recycling of old equipment). This should be targeted at residential equipment such as furnaces/boilers, air conditioners, heat pumps, refrigerators, washing machines, and hot water heaters, and commercial and industrial equipment such as motors and electric process equipment.

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- Expand use of ground-source heat pumps in lieu of air-source heat pumps.
- Air conditioning equipment and hot water heater cycling in peak demand periods.
- Financial incentives for upgrading lighting to more efficient units.
- Demonstration programs for emerging technologies, such as light-emitting diode (LED) lighting, infrared heating/drying, ultraviolet light sterilization, and others.
- Education and unbiased, non-commercial information to consumers on cost-effective energy-efficiency actions.

New technologies such as smart grid improvements also may provide opportunities to improve the efficiency of the utility network.

In 2007 Virginia removed a disincentive to electric utilities investing in these activities when it changed how these utilities are regulated. Utilities will no longer be permanently penalized for reductions in sales due to energy-efficiency improvements. Utility revenues will be reviewed on a two-year cycle, with the ability to adjust rates for any under-recovery of return on equity. Additionally, Virginia's electric utilities are authorized to recover direct costs of energy-efficiency program expenses. With these disincentives removed, Virginia's investor-owned electric utilities should invest in all cost-effective energy-efficiency activities. Virginia's electric cooperatives and municipally owned electric utilities should also maximize cost-effective investments that result in a total cost reduction to their members or residents.

These activities will require incentives to overcome consumer-implementation barriers. Based on the level of incentives in successful programs in other states, \$100 to \$120 million per year is needed to reach the 10 percent electric savings goal.

Virginia's retail electric sales totaled 108.9 billion kilowatt-hours in 2005. Meeting the 10 percent goal based on 2005 sales would have reduced electricity sales by 10.9 billion kilowatt-hours. This would be

equivalent to a reduction of 7.2 million metric tons of carbon dioxide emissions, or approximately 5.5 percent of the estimated 130 million metric tons of total carbon dioxide emissions in 2005 in Virginia.

Virginia also should take additional policy actions targeted at reducing consumption of other fuels. For example, natural gas utilities have a disincentive to promote energy efficiency. Distribution rates for non-industrial consumers are closely tied to the customers' use of gas. This provides an incentive for local distribution utilities to promote higher usage in order to recover the fixed costs of their distribution systems and maximize profits. Natural gas utilities in a stable or declining market have a reduced ability to recover their fixed costs if sales are reduced by conservation activities.

This market barrier can be overcome through careful use of revenue decoupling. Revenue decoupling, combined with strategies to promote energy conservation by natural gas users, can provide benefits to direct program participants through lower natural gas bills as well as benefits to other consumers through utility cost savings in peak natural gas purchases, purchases of firm and interruptible pipeline capacity, and balancing services. These savings can offset cross-subsidization of participating customers by non-participants.

Use of revenue decoupling for reasons other than energy-efficiency and conservation actions must be implemented carefully. Many factors affect natural gas sales, such as year-to-year changes in weather and economic activity in a utility's service territory. Where daily consumption rates are trending lower, utilities should be able to recover investments needed to maintain existing networks and add capacity to meet peak-day loads. Revenue decoupling can serve as a variable tool to encourage infrastructure investment in an environment where average daily use is declining. However, revenue decoupling should provide protection against excessive recoveries due to increases in sales from weather and economic expansion.

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Natural gas energy-conservation activities should include financial incentives and educational support for replacing old, less efficient natural gas space and hot water heating and process equipment with high-efficiency furnaces, hot water heaters and process equipment, tankless water heaters, radiant heaters, and more efficient commercial cooking and baking equipment.

Virginia's natural gas producers, transmission pipelines, and local distribution utilities should broadly implement the Gas Star recommendations to conserve natural gas by reducing leakage in production, transmission, and distribution operations. Some activities are ongoing today. For example, some Virginia natural gas local distribution utilities have been upgrading old underground piping systems to eliminate leaks. The SCC has supported these efforts through its prompt consideration of cost recovery for these efforts. Virginia's natural gas utilities and the SCC should be commended for this effort. Both Virginia's public and municipal natural gas utilities should continue with these efforts to conserve natural gas resources through reducing leaks.

Energy Conservation for Low-Income Virginians

The Weatherization Assistance Program funds improvements to eligible low-income households. These include repairing and replacing heating and cooling equipment, sealing air leaks, and insulating buildings, ducts, and hot water heaters. This program works most efficiently with a stable flow of funds from year to year because of the need to maintain crews and equipment. It does not readily react to one-time infusions of funds. Virginia should expand the capacity of the Weatherization Assistance Program, using a reliable, long-term source of funds to serve a greater percentage of eligible households per year. Two million dollars per year would allow the program to serve an additional 715 households per year. Other housing programs that assist low-income families should also incorporate energy efficiency into their efforts.

Through these activities, households' energy bills and need for other energy assistance can be reduced.

Low-income Virginians receive assistance paying their energy bills through the Low-Income Home Energy Assistance Program (LIHEAP). Primary funding for LIHEAP comes from the federal Low-Income Home Energy Assistance Program grant. Virginia has provided additional funding to LIHEAP, both from the general fund and Temporary Assistance to Needy Families funds, during times of sharply rising and high-cost energy. Virginia should continue to provide increased LIHEAP funding at such times and should improve coordination among public and private energy assistance programs.

Options to reduce the need for energy assistance, such as utility disconnect moratoriums, discounted "lifeline" rates, and waivers on reconnection fees, should be examined for applicability in Virginia.

Energy Education

Virginia should implement an energy-conservation public education program to overcome consumer market barriers and make consumers confident in making energy-efficiency improvements. Information should be seen as coming from an unbiased source. Consumer education should be targeted toward:

- Homeowners and renters, addressing the use of energy-efficient appliances, equipment, and daily practices. Special emphasis should be made with low-income households as they typically reside in less energy efficient housing stock.
- Commercial building owners and business managers, addressing the values of more energy efficient construction such as Leadership for Energy and Environmental Design (LEED) and Energy Star. This also should include benchmarking energy use, guidance on use of performance contracting, and similar topics. Business-related education also should promote participation in federal programs such as the Green Lodging program.
- Primary and secondary school students,

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incorporating energy efficiency into Standards of Learning requirements. This should include providing the necessary tools and training to teachers to incorporate energy efficiency into their lessons.

As part of this program, Virginia should encourage development of a green/energy-efficient product and material label, and be an early adopter as one is developed. For example, the Energy Star label could be expanded to include materials and equipment beyond appliances, office equipment, and buildings. If the federal Energy Star labeling program cannot be expanded, Virginia should support implementation of an independent, energy-efficiency label program. This effort should be coordinated with utility and retail store communication programs.

Virginia should more widely promote web-based education resources, such as the *Virginia Energy Savers Handbook*, to consumers. The state can expand distribution of information on and from the handbook, including direct distribution of copies to high-value audiences, flyers and other advertising on how to find energy-conservation information on the Virginia state government Internet pages, and expanded distribution through Virginia's cooperative extension offices.

There are numerous governmental programs that can provide energy-efficiency best practices and education to consumers. These include programs such as Clean Cities, Rebuild America, Climate Leaders, Cool Cities, and others. Virginia should promote use of the educational materials available through these programs.

An effective, statewide energy-education program will require \$1 million per year to support development and delivery of energy information to consumers.

Virginia should continue to actively promote recycling. Many Virginia localities already recycle a substantial portion of their wastes. Reuse and recycling programs result in less energy expended to make new products from raw materials.

Building Efficiency and Conservation

Virginia uses the International Building Code as the basis for the Uniform Statewide Building Code. The International Building Code's energy code is updated on a three-year cycle to reflect updated technology and building practices. Virginia has regularly updated the Uniform Statewide Building Code to incorporate the updates to the International Building Code. This has kept Virginia's minimum construction practices up to date with the current minimum requirements.

Incorporating additional cost-effective energy improvements into new construction can help improve housing affordability by reducing total cost of home ownership and by reducing the amount of energy used in the state's institutional, commercial, and industrial buildings. The Commonwealth should ensure that the energy requirements in the Uniform Statewide Building Code result in the most efficient energy performance that is cost effective. This may require use of energy codes more stringent than those in the model International Building Code.

Virginia should provide training to building code officials, architects and engineers, and the building community about how to properly meet energy codes and use more energy-efficient building standards such as LEED, Energy Star, and EarthCraft Homes. These efforts would increase the number of design professionals and builders certified under these programs. This effort should be targeted to both the commercial and residential markets.

Virginia should work with its building community to provide additional energy-conservation education to the industry's workforce. This should include training on proper sizing and installation of energy-using equipment, proper construction practices, and operations and maintenance training. These efforts could be provided through the Virginia Community College System or targeted workshops offered across the state.

Virginia should initiate a home energy-

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rating system for new and existing homes using an existing rating system such as that provided by the Residential Energy Services Network.

Industrial Efficiency and Conservation

Virginia should create energy assessment centers, similar to those provided under the U.S. Department of Energy's industrial energy assessment center program, to provide energy audits and assessments to commercial and small industrial consumers. This could be managed through Virginia's university engineering and science programs or through non-governmental organizations such as chambers of commerce or regional planning districts. The program could use engineering students and professors and retired engineers to provide the assessments and tools from the numerous federal energy efficiency programs such as Energy Star, Industries of the Future, steam and motor efficiency programs, and GreenLights.

Virginia should assist industrial consumers to implement waste-to-energy, heat recovery, and combined heat and power projects. These projects represent the largest opportunities to replace higher-cost conventional energy sources, using energy sources and materials that typically are wasted.

New Technologies

New technologies are regularly being introduced into the marketplace that can use less energy to perform needed tasks. Virginia should monitor new technology development and provide financial support to encourage early adoption of emerging energy technologies. Current examples of such technology include residential and commercial LED lighting, fiber-optic daylighting, microgeneration systems, cool roofs, computer network controls, and new automobile technologies.

7.1.2 Federal Policies for Energy Efficiency and Conservation

The federal government plays a leading role in promoting energy efficiency and

development of reliable energy supplies through tax policy and direct financial assistance, research and development (R&D), energy data publication, equipment and vehicle standards, and public education.

The federal government should continue providing the numerous energy efficiency and conservation, R&D, energy data, grants, and other services to residential, commercial, industrial, and institutional consumers. As part of this work, the federal government should increase its investment in energy efficiency and conservation and alternate energy development, and support state efforts to deliver these services to energy consumers. These investments should be provided at a reliable level over a multiyear period to ensure that partners can efficiently plan and implement new investments.

The federal government also should provide sufficient funding for energy development activities to reach a critical mass and bring new technologies to deployment.

Many energy policies should be implemented on a national or regional basis, as state implementation can introduce dysfunction into markets or lead to duplication and inefficiencies. For example, northern Virginia's appliance markets overlap with those in Maryland and the District of Columbia, and the southwest Virginia appliance market overlaps with the Tennessee Tri-Cities market. Limiting sales to only high-efficiency models in the Virginia portion of these markets might drive consumers across state lines to purchase lower first cost units, taking the economic activity away from Virginia and negating any energy savings from more efficient equipment. Virginia encourages the federal government to more broadly implement improved appliance efficiency requirements. If neighboring jurisdictions set higher appliance standards, Virginia should consider setting regional appliance efficiency standards in the common market areas.

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Transportation is the single largest energy-using sector, but saving energy in transportation has proven difficult. To improve energy efficiency in transportation, the Corporate Average Fuel Efficiency (CAFE) standards for vehicles should be increased by 10 miles per gallon over the next ten years, to 37.5 miles per gallon for automobiles and 32.2 miles per gallon for light trucks, with off-ramps for proven technical or safety roadblocks. CAFE standards should be based on actual mileage and should not be adjusted upward based on use of alternate fuels in fleets.

CAFE protocols should be periodically adjusted to account for changing driving conditions, such as urban/suburban/rural driving patterns, typical congestion delays, and typical speeds driven. This will help CAFE standards better approximate actual driving experiences and lead to more accurate vehicle-mile-per-gallon estimates.

While market drivers such as tax credits will help increase transportation fuel efficiency, a mandatory increase in CAFE standards will be more effective in conserving gasoline and other transportation fuels.

7.1.3 Local Government Policies for Energy Efficiency and Conservation

Several early-adopting Virginia localities are implementing policy decisions to encourage private energy-efficiency and conservation actions in their localities. Additional Virginia localities should follow their lead in adopting policies to encourage additional private energy conservation actions. These policies can take the form of tax policy, as well as land use and zoning, transportation, and operational decision making.

Localities should take advantage of authority granted under 2007 legislation and create a separate real-estate classification and lower tax rate for buildings that are 30 percent more efficient than required by building code.

Localities should adopt land-use plans that

allow higher density development near mass transit nodes and encourage mixed-use communities, urban redevelopment, and infill development.

Localities should allow higher density development for projects meeting LEED standards and streamline and reduce permitting fees for LEED buildings.

Localities should consider how development and transportation patterns affect energy use when developing their comprehensive plans. Localities also should assess the use of conservation easements and purchase of development rights as a way to preserve open space and direct development toward areas with mass transportation available.

Localities should take advantage of authority granted under 2007 legislation to enter into agreements with nonpublic schools to provide student transportation, increasing the efficiency of the overall student transportation system.

Localities should support development of new renewable energy and distributed energy applications. Localities should use the Virginia Renewable Site Scoring system developed under authority of 2006 Senate Bill 262 in their local land-use decision-making process.

Localities should consider sharing landfill tipping fees with projects that convert waste to energy and which, in turn, reduce waste volume and extend the life of the locality's landfill.

7.1.4 Energy-Efficiency and Conservation Actions in Government

State Government

Government should lead by example and implement all cost-effective conservation opportunities.

State government energy-conservation goals have been set out in Executive Order 48, issued on April 5, 2007, calling for Virginia state agencies and institutions to reduce conventional energy expenditures by 20 percent between 2007 and 2010. The executive order also directs state

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agencies and institutions to:

- Use certified energy managers to support energy management activities if their energy bills exceed \$1 million per year.
- Construct new buildings over 5,000 square feet in size and complete renovations valued over 50 percent of a building's assessed value using the energy components of the Leadership for Energy and Environmental Design (LEED) certification or Energy Star standards.
- Lease space in metropolitan areas near public transit, and at sites that are pedestrian and bicycle friendly and give a lease preference to LEED- or Energy Star-rated buildings.
- Minimize vehicle miles traveled related to state operations, implement transit and ride-sharing programs, maximize use of E85 and B20 fuels, and include fuel efficiency and emissions in vehicle purchase decisions.
- Purchase Energy Star equipment whenever a classification exists for the equipment, purchase all recycled paper-compatible copiers, printers, and related office equipment, and purchase recycled paper except where equipment limitations precludes its use.

State government also has completed an operational review of energy use to identify other opportunities for energy management and efficiency improvements. This review identified additional best practices that state agencies and institutions should use.

- Create a Virginia Energy Management Program to provide for more coordinated management of energy issues, training for and communication among state energy managers, and evaluation of new technologies and processes.
- Purchase natural gas from centralized contracts, using underground gas storage, price locks, futures, and pipeline transportation contract tools to minimize natural gas purchase costs.
- Pilot recommissioning of state buildings to ensure that their energy-using systems work as designed.

- Integrate centralized management of utility billing with the new state enterprise management system.
- Coordinate a multiagency participation in the PJM demand-response program.
- Encourage broader participation in the Department of Environmental Quality's Environmental Excellence Program.
- Consider a central fund for energy-efficiency improvements to replace third-party funding in energy savings performance contracts to allow the Commonwealth to retain a higher percentage of savings.

Federal Government

Federal government agencies have taken many actions to reduce their energy use and use alternate supplies of energy. The Federal Energy Management Program is a model for energy management. The Commonwealth should pursue opportunities to work with federal facilities on energy management through the Virginia Regional Environmental Management System.

Local Governments

Several Virginia's localities are implementing actions to manage energy use. For example, the Cities of Alexandria, Charlottesville, Portsmouth, Richmond, Roanoke, Virginia Beach, and Williamsburg and the Town of Blacksburg have signed the U.S. Mayors Climate Protection Agreement under the Cool Cities program. They have pledged to take significant local actions to conserve energy use in their operations and among their citizens. Arlington County has instituted numerous energy-savings actions in its operations, including use of hybrid vehicles in its fleet and reductions in energy use in facilities.

All Virginia localities should follow the lead of these early-adopting local governments and implement all cost-effective, internal energy conservation opportunities.

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7.1.5 Individual Consumer Energy-Efficiency and Conservation Actions

Each Virginian affects the state's energy future through day-to-day actions and long-term lifestyle decisions. Many small decisions collectively can make a big difference in state energy use. In making these decisions, people should use energy conservatively so that supplies will continue to be available to meet our needs.

There are many easy day-to-day choices people can make to use energy more efficiently.

- Virginians should follow the advice of their mothers and fathers to turn lights, televisions, and equipment off when not needed.
- How Virginians drive affects energy use. Plan trips to reduce the total miles driven. Simple acts such as combining trips, walking, bicycling, and using transit all add up to save energy in transportation and reduce emissions. Avoid overly fast stops and starts and traveling at excessive speeds.
- Consumers have similar opportunities to conserve energy in other motorized equipment such as lawn mowers and boats. Keep equipment properly maintained, and don't unnecessarily leave equipment or motors idling. Operating boats at recommended speeds saves fuel. For example, if a boat travels 24 miles per hour (20 knots) at 5,000 rpm versus 22 miles per hour (18 knots) at 4,000 rpm, it will burn considerably more fuel with only a very small gain in speed.
- Dress appropriately for the season, and set thermostats on heating or air conditioning units only as high or low as needed for comfort.

Virginians should also consider the energy impacts of longer-term lifestyle decisions such as where we live or how we use transportation.

The largest financial decision most people make is in purchasing a home. This decision will have a long-term impact on the amount of energy use.

- Purchasing a home where you can walk or use transit to work, shop, and go to school, and using school buses for travel to and from school instead of individual cars, will reduce your total energy footprint.
- Make sure your home is insulated and leakfree to reduce energy use and energy bills over its life. This can be done by purchasing a highly efficient new home, such as one from an EarthCraft homebuilder or an Energy Star home. A list of Virginia's EarthCraft homebuilders is available on the Internet at www.southface.org. Homeowners may also be eligible for special loans for energy-efficient houses. These mortgages recognize that homeowners pay less of their income for energy so more is available for mortgage costs. Homeowners may be eligible for a higher debt-to-income ratio on such mortgages.
- In existing homes, seal cracks, add insulation and proper ventilation, repair or replace leaky windows, and replace old, inefficient equipment. There are energy audit providers who can provide home-specific recommendations through physical inspections and use of thermographics, blower doors, and other assessment tools. Energy-savings improvements in existing houses readily lend themselves to do-it-yourself projects. Many building material suppliers offer how-to clinics on simple energy-savings improvements.
- Other recommended actions to improve the efficiency of homes are available in the *Virginia Energy Savers Handbook*, available on-line at www.dmme.virginia.gov/DE/ConsumerInfo/consumerinfo.shtml.

Virginians can reduce energy use and costs through purchasing decisions.

- Participate in activities such as Energy Star's Change a Light, Change the World program, through which consumers exchange incandescent lightbulbs for compact fluorescent lightbulbs, and the Cool Your World Campaign, which encourages consumers to use Energy Star-qualified cooling products, seal leaks that let out cool air, and get annual air-conditioner or heat-pump service.

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- Consumers use appliances, equipment, and vehicles for many years. Purchasing high-efficiency units results in long-lasting savings. Always purchase Energy Star items when available. For example, one of the largest energy-using appliances in many homes is the refrigerator. A new Energy Star-rated refrigerator uses 40 percent less energy than conventional models sold as recently as 2001. Also, if you purchase a new refrigerator, don't just hook up the old, inefficient unit in your garage or basement. This just increases your electric use. Dispose of your old refrigerator at your local center that recycles white goods.
- Virginians should also purchase higher efficiency appliances and equipment fueled by natural gas, propane, or fuel oil that are not rated under the Energy Star program. A high-efficiency natural gas water heater can save approximately \$50 per year over a standard model based on typical 2007 Virginia natural gas prices. Installing low-flow showerheads uses less hot water, sewer, and energy.
- Use of ground-source heat pumps is another option that works well in Virginia. Our climate creates demands for heating and cooling. A ground-source heat pump works more efficiently during both seasons, increasing the cost effectiveness of the equipment. A ground-source heat pump used in Virginia is typically about 25 percent more efficient than a standard air-source heat pump.

One of the largest users of energy is vehicles. While individuals have many reasons to choose a particular vehicle make and model to meet their needs, each of us should make fuel efficiency a primary factor in our vehicle purchase decisions. See the recommendations in Section 7.1.9, Energy Efficiency in Fleets/Transportation, for more information.

There are many actions we can take that, while not directly saving energy, have an indirect effect on energy conservation. For example, purchasing goods with less packaging reduces the energy used to create the packaging and ship the products. Purchasing locally grown produce reduces

energy used for transporting the products to market. Reusing and recycling materials saves the energy used to produce new goods from raw materials. Many jurisdictions in Virginia offer recycling for paper, metal, glass, and plastics. Used motor oils can be taken to collection centers. Appliances and other white goods can often be recycled at local waste transfer stations or landfills. Many areas offer special collections for electronic and chemical wastes. Many homeowners can use yard wastes for compost or separate them for separate yard-waste collections.

For more information on what you can do to use energy wisely, see the *Virginia Energy Savers Handbook* and other consumer information at www.dmme.virginia.gov/DE/ConsumerInfo/consumer-info.shtml or the U.S. Department of Energy's (DOE's) *Consumer Guide to Energy Efficiency and Renewable Energy* at www.eere.energy.gov/consumer.

7.1.6 Commercial Business Energy-Efficiency and Conservation Actions

Just as individual consumers can change our energy future, commercial business can take actions to increase the efficiency of energy use in Virginia.

Since most businesses' first priority is to serve customers and not manage their energy use, energy will often go unattended without specific responsibility being assigned. The first action businesses should take is to assign a person or team to be responsible for energy management. This is consistent with the Energy Star program's recommendations (see www.energystar.gov/index.cfm?c=guidelines.guidelines_index) or the ANSI/MSE 2000:2005 energy management system (see <http://innovate.gatech.edu/Default.aspx?tabid=2008>). Businesses also can receive energy management assistance from trade groups or their local utilities.

Businesses also should participate in the Virginia Environmental Excellence Program. This can provide a framework to integrate energy and environmental actions into one coordinated effort.

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Information is available at www.deq.virginia.gov/veep.

Using these tools, businesses can use benchmarks, such as the Energy Star Portfolio Manager, to measure how efficiently they are managing energy. If a business finds it is using more than best practice benchmark standards, it should use an automated auditing tool or an outside professional energy auditor to determine opportunities to reduce energy use.

Businesses should take advantage of programs designed to help specific types of commercial operations. For example, Energy Star has specific information for auto dealers, grocery and convenience stores, home-based businesses, lodging, and restaurants.

Commercial businesses have a long-term impact on energy use through their construction and rental decisions. Constructing high-efficiency buildings, such as meeting the energy standards for LEED buildings, can increase first costs by 2 to 3 percent, but the investment will be returned through lower operating costs in as little as four years. While location is critical for many commercial buildings, commercial business managers should give priority to energy efficiency when renting space. Commercial businesses should consider locating near public transit whenever possible, making businesses more accessible to both customers and employees.

If a business owns an inefficient building, the business owner should consider investing in efficiency improvements or use energy savings performance contractors to implement energy-savings improvements.

Recommissioning, which is like a building tune-up, can offer many businesses a high return on costs. Many older commercial buildings are not operating as designed. Equipment may be improperly calibrated, leading to excessive run time. Filters may be dirty, resulting in increased power to move air or liquids. Control sequences may no longer match equipment or space needs. Studies have found that building

recommissioning can often have a less than a one-year payback. Commercial property that has not had a rigorous preventative maintenance program should be recommissioned if the building has been in operation for more than ten years. Commercial businesses should also be sure that new buildings, whether self-built or leased, have been properly commissioned to reduce ongoing energy use and costs. See the Energy Star guide to building recommissioning at www.energystar.gov/ia/business/BUM_recommissioning.pdf.

Commercial businesses should reduce their energy bills through purchase and use of high-efficiency equipment. Businesses should always purchase Energy Star equipment when available.

High-quality lighting is critical to most retail businesses. Retail businesses should maximize use of daylight to reduce daytime electrical lighting and should select the most efficient sources of lighting that provide proper color control for their business needs.

Many commercial businesses operate service or delivery fleets. Businesses should carefully consider fuel efficiency when purchasing vehicles for their fleets. Businesses should also ensure that their fleets are properly maintained, that drivers are trained on energy-efficient driving techniques, and that routes are planned to minimize wasted driving and congestion. Additional transportation energy savings recommendations are found in Section 7.1.9 of this chapter.

7.1.7 Industrial Energy-Efficiency and Conservation Actions

While Virginia industries have many of the same energy-conservation opportunities as commercial businesses, manufacturers have the extra opportunity to conserve energy in their processes. Energy is the second largest cost after personnel for many industries. Energy cost savings typically directly improve a company's bottom line.

Industrial concerns should follow best practice energy management models such

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as the Energy Star or ANSI/MSE 2000:2005 protocols for managing energy use. They should include energy efficiency in their building and purchasing decisions and fleet management.

Virginia industries can find more information through the federal Energy Star program (see www.energystar.gov/index.cfm?c=manuf_res.pt_manuf) and the DOE's Industrial Technology Program (see www1.eere.energy.gov/industry/bestpractices/systems.html). These programs provide best practices to address energy-using areas such as motors, pumps, and fans, process heating, steam, and compressed air.

Technical and financial assistance in identifying energy-savings opportunities is available to small, medium, and large industries. Small industrial concerns within 150 miles of a federal DOE Industrial Assessment Center, such as those located at North Carolina State or West Virginia University, can receive energy audits by a team of engineering students and faculty (see www.iac.rutgers.edu). On average, savings from assessment recommendations total \$55,000 per year. The Industrial Assessment Center website also has a database of more than 11,000 recommendations made during business assessments.

Mid-sized industrial concerns can receive financial support for a plantwide energy assessment (see www1.eere.energy.gov/industry/bestpractices/plant_wide_assessments.html).

Large industrial sites should use federal Energy Savings Assessments to help reduce energy use and intensity (see www1.eere.energy.gov/industry/saveenergynow/assessments.html).

Large industrial operations should pursue cost-effective opportunities to use combined heat and power applications. Industries can generate power from high-pressure steam and use the resulting lower pressure steam to operate processes. This can result in a highly efficient use of energy and in cost savings. More information is available from the Virginia Department of Environmental Quality (see

www.deq.virginia.gov/innovtech/der1.html).

Many industrial businesses operate motorized equipment and delivery fleets. Businesses should look carefully at fuel efficiency when selecting vehicles and equipment. Industries should also ensure that their fleets are properly maintained, that drivers minimize equipment idling and are trained on energy-efficient driving techniques, and that routes are planned to minimize wasted driving and congestion. Additional transportation energy savings recommendations are found in Section 7.1.9 of this chapter.

7.1.8 Agricultural and Forestry Energy-Efficiency and Conservation Actions

Many resources are available to help Virginia's agricultural and forestry industries improve their energy efficiency.

The U.S. Department of Agriculture offers energy programs and recommendations for farms and agricultural businesses (see www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB?navid=ENERGY&navtype=MS). Additional information on energy efficiency in agricultural operations is available from the National Resources Conservation Service (see www.nrcs.usda.gov/technical/energy).

Virginia's forest products industry should implement the recommendations in the U.S. DOE's Forest Products Industry of the Future Program (see www.eere.energy.gov/industry/forest/partnerships.html).

7.1.9 Energy Efficiency in Fleets/Transportation

Three paths should be followed to reduce energy impact from transportation.

- Reduce the amount of energy used by reducing vehicle miles traveled, increasing the use of higher-efficiency forms of transportation, implementing congestion-mitigation actions, and increasing availability and use of high-occupancy vehicle (HOV) and high occupancy toll (HOT) lanes.
- Increase the efficiency of vehicles and

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fleets.

- Replace imported petroleum with renewable liquid fuels.

Many transportation energy problems are better implemented through national action. However, there are numerous transportation improvements available at the state level.

Reducing Vehicle Miles Traveled

Virginia should implement a portfolio of transportation demand-management tools. This should include providing adequate capital and operating funding to create easy alternatives to daily single-occupant vehicle commutes. These options should include providing state support, in conjunction with local actions, to ensure that Virginians have access to reasonably priced and regularly scheduled mass transit service in our urban and suburban areas. These services should be tied to park-and-ride facilities for rural residents traveling into urban areas and should include support for Virginia's fifty-six bus, commuter rail, and intercity rail systems. Virginia should also support development of new light rail systems such as the proposed Norfolk Light Rail project.

Commercial and industrial fleet operators should plan vehicle routes and schedules to minimize mileage and travel during highly congested times.

Significant land-use barriers stand in the way of improved transportation energy use. Current land-development patterns often discourage non-motorized transportation by separating residences from workplaces, shopping, and other attractions. State and local governments should better integrate land-use and transportation planning. They can encourage land-use patterns that allow for construction of safe and accessible facilities for non-motorized transportation. Developers should include facilities for no- or low-fuel methods such as walking, bicycling, and small scooters consistent with the Commonwealth Transportation Board's *Policy for Integrating Bicycle and Pedestrian Accommodations*. State agencies addressing transportation and energy

should monitor performance measures for per capita transportation energy use and vehicle miles traveled as a measure of transportation energy efficiency.

Some roadway design standards can deter higher density development similar to those found in older urban communities. For example, wide minimum road widths may prohibit some compact land-use designs. Virginia should review its roadway design standards to evaluate whether changes can be made to facilitate higher density development in urban areas.

Virginia should expand the use of HOV and HOT lanes. These provide the driving public with premium and predictable travel conditions when conditions are often congested. They also increase the through-put of vehicles, reduce congestion, and save energy. Energy savings come from increased vehicle efficiency due to operating at constant speeds, increased occupancy in HOV lanes, and reduced traffic backups. Additionally, buses using HOV and HOT lanes can provide more efficient service to transit users. HOV and HOT lanes should be actively considered in regional transportation plans for Virginia's major urban areas. Virginia should give high priority to other congestion-mitigation projects in allocating its transportation funding. Specific projects that should be pursued include providing HOV/HOT lanes farther south on I-95 and on the Capital Beltway, and as transportation density increases, on highways in the Hampton Roads and Richmond areas.

The Commonwealth should continue to promote use of alternate methods to the daily commute such as telecommuting, ride-sharing, and car-sharing. These activities should be promoted through increased public education, increased availability of broadband infrastructure, and provision of regional telecommuting centers. Localities should be flexible in providing priority locations for car-sharing services.

Virginia should make concerted actions to move truck freight to rail and barge. Barriers to increased rail freight use include the needed capital investment in

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infrastructure to improve rail corridors and truck-to-rail-to-truck facilities; reliability, timeliness, and predictability of service; and business perspectives. To overcome these barriers, Virginia should continue to implement the Heartland Corridor Project and include, as part of I-81 improvements, facilities to move freight from truck to rail. Virginia should also continue to provide incentives for business access to rail in its economic development programs.

Increasing Fleet Efficiencies

Individuals and businesses should look carefully at fuel efficiency when selecting vehicles and equipment. There are many fuel-efficient options that will meet transportation needs. Consumers should look for higher efficiency vehicles, hybrid gas-electric vehicles, flex-fuel vehicles that can use gasoline or E85, and new clean-burning diesel vehicles.

Driving a vehicle 12,000 miles per year that gets 38 rather than 28 miles per gallon, at \$2.50 per gallon, saves 113 gallons of gasoline and \$282.50 per year. This is a 26 percent reduction in gasoline use. Using a very efficient vehicle such as a hybrid electric at 50 miles per gallon would increase savings to 189 gallons and \$472.50, a 44 percent decrease in gasoline use. If you own your car for seven years, you would save 791 gallons of gasoline and \$1,977.50. Over the seventeen-year average life of a car, this totals a savings of over 1,900 gallons of gasoline and over \$4,800 for the energy-efficient car and over 3,200 gallons and \$8,000 for the hybrid electric car.

Vehicle owners should keep vehicles properly maintained. The most important maintenance practices include keeping tire pressures at recommended levels and keeping vehicles properly tuned up. Fixing a car that is noticeably out of tune or has failed an emissions test can improve its gas mileage by an average of 4 percent, though results vary based on the kind of repair and how well it is done. Fixing a serious maintenance problem, such as a faulty oxygen sensor, can improve mileage by as much as 40 percent. More

information is available through the Commonwealth's Driver Education Core Curriculum.

Virginians should drive smart to save fuel. Steady acceleration and deceleration, using cruise control, and slowing down can significantly increase fleet efficiencies. Tests of aggressive versus calm driving in cities show up to 25 percent savings using best driving practices. For every 5-mph decrease on the highway, a typical driver will save 5 percent in fuel.

Virginia has historically been a leading state for gasoline-electric hybrid vehicle use. Demand in northern Virginia has been driven by the ability of hybrid cars to use HOV lanes. However, Virginia has recently restricted use of newly purchased hybrid vehicles on HOV lanes. Use of highly fuel efficient hybrids on HOV lanes can balance HOV goals of mitigating congestion and reducing energy use in transportation.

The Commonwealth should carefully evaluate the effect this has on the rate of hybrid vehicle market penetration. If the market penetration rate declines in relation to other states, Virginia should work with the federal government to reconsider the ban for the most fuel efficient hybrid vehicles. For example, any hybrid with over a 50-mpg combined EPA mileage rating could still be allowed to obtain clean special vehicle license plates and use the HOV lanes.

For every 5 percent per year reduction in gasoline use in Virginia, we would save 260 million gallons of gasoline, save more than \$500 million, and reduce carbon dioxide emissions by nearly 2 million tons per year, or approximately 1.5 percent of Virginia's total carbon emissions.

Using Alternate Transportation Fuels

Virginia has instituted efforts to increase the use of alternate transportation fuels. The Biofuels Incentive Program provides a 10-cent-per-gallon incentive for production of biofuels from domestic feedstock. This program should be fully funded. Additionally, the Virginia Economic Development Partnership, Department of

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Agriculture and Consumer Services, and Department of Mines, Minerals and Energy should continue to work with prospective companies to increase the amount of alternate transportation fuels produced in Virginia.

Virginia should consider mandating use of 10 percent ethanol and 5 percent biodiesel in all retail fuel sales when there are sufficient supplies available from non-food crop sources to support this use. Any mandate should be coupled with incentives for fuel terminals to make the necessary infrastructure improvements to handle the new fuel mixes.

Virginia should also assist with increasing the market availability of E85 and B20 or greater biodiesel. This should include assistance in locating more alternate fuel retail stations through incentives for biofuel islands in our urban centers and no more than every 75 miles along the Commonwealth's interstate highways.

Virginia should implement a highway signage program directing motorists to E85 and biodiesel retail outlets. This should be done in conjunction with neighboring states and the District of Columbia to provide a uniform sign format.

Virginia should amend its statute and regulations to allow for flexibility in blending conventional and alternate fuels to facilitate increased alternate fuel sales. For example, Virginia gas-station owners must post signs on pumps providing 10 percent ethanol reformulated gasoline. These signs were first put in place when older cars would have been harmed by the ethanol mix. Today, all cars are designed to accept the 10 percent ethanol mix.

This signage requirement restricts the ability of owners of stations outside areas requiring use of reformulated gasoline from using the 10 percent ethanol product when it is cost effective to do so. Virginia should repeal the ethanol content pump labeling requirements to provide gas-station owners with increased flexibility to use conventional or reformulated gasoline in areas where reformulated gasoline is not required.

Virginia would benefit by increased use of hydrogen as a transportation fuel. Virginia's hydrogen fuel stakeholders have produced the blueprint for Virginia's hydrogen future. The Commonwealth should, consistent with this blueprint, carefully monitor the potential for hydrogen technologies to serve Virginians' energy needs.

Virginia also should facilitate education about hydrogen fuels. Hydrogen should be addressed in the state's higher education engineering curriculum. The Commonwealth should continue to incorporate hydrogen education in its primary and secondary education through expanded use of the National Energy Education Development Program hydrogen curriculum.

7.1.10 Higher Education Energy-Efficiency and Conservation Actions

Virginia's higher education institutions can lead by example by implementing energy-efficiency actions across their campuses. These actions will not only reduce energy use and lower energy bills but will also help educate our next generation of leaders on how to manage energy wisely in their lives.

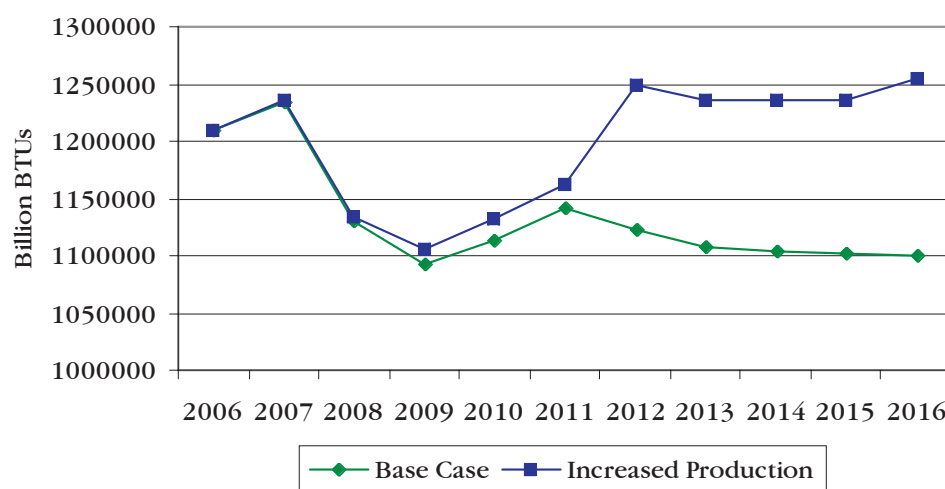
Virginia universities should expand involvement in the Greening the College Campus or similar activities to increase the energy efficiency of university operations.

7.2 Virginia's Energy Infrastructure and Supplies

Virginia must ensure that there is an adequate infrastructure to provide needed energy supplies to Virginia. The Commonwealth will need to address electric supply, natural gas, petroleum, and coal infrastructure, as well as how this

infrastructure is protected from security risks. This Plan sets out a goal to produce 20 percent more energy in state than would be produced without the actions recommended in this plan (see Figure 7-3). Meeting this goal will require increased in-state electric and liquid fuel production, and a stabilization of coal production.

Figure 7-3 Virginia Energy Production Trends



7.2.1 Electric Supply Infrastructure

The electric infrastructure is the most widespread energy system in the state. It is critical to understand how electric demand will grow in order to adequately plan how resources will be provided. In particular, PJM has stated that Virginia's electric supply infrastructure in northern Virginia will need expansion by 2011. Studies also show the need for additional electric system capacity to serve the Tidewater region.

While conservation and demand control may delay when any expansion of Virginia's electric infrastructure is needed, analysis cited in this Plan has shown that growth in electric use will overtake the generation and transmission system's capacity, resulting in the need for new infrastructure. If Virginia is to reduce its

reliance on imported electricity, this would add to the stress on the state's generation and transmission system.

Virginia's investor-owned utilities will be required to file, coincident with their biennial rate filings before the State Corporation Commission (SCC), plans for projected generation and transmission requirements to serve their native load for the next ten years. Virginia's utilities should provide sufficient information with this filing for the public to understand the assumptions used to make these estimates. A broad public understanding of the Commonwealth's future electric demands and plans to meet these demands should help reduce the contention over new electric infrastructure development.

Growing electric demand can be met through new conventional and renewable

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electric generation, reducing demand through efficiency and conservation, or importing electricity over transmission wires from remote generation plants. Virginia should require developers of conventional electric generation capacity to be paid for by Virginia's utility consumers to show, as a condition of receiving a Certificate of Public Convenience and Necessity, that the proposed conventional generation is needed after all cost-effective energy-efficiency and conservation actions have been implemented and that the conventional generation is less expensive than new renewable generation capacity.

Providing the new electrical infrastructure needed to meet growing demand will require billions of dollars of investment in new facilities. For example, as of the release of this Plan, Virginia's utilities are working to develop the Virginia City Hybrid Energy Center, Integrated Gasification Combined Cycle (IGCC) plants, increased gas-fired peaking capacity, new nuclear power plant capacity, and renewable energy capacity. Virginia should ensure that its electric utilities have access to low-cost capital for investments needed for this new capacity.

The federal DOE has proposed to designate the area from West Virginia and western Pennsylvania to the New York City to northern Virginia areas as a National Interest Electric Transmission Corridor (NIETC). This designation means that a transmission line developer may apply to the Federal Energy Regulatory Commission for approval to construct a line if Virginia or neighboring states fail to approve the construction of a line within twelve months of submittal of a complete application to the state.

To ensure timely review of electric transmission line applications, utility companies should complete sufficient pre-application work to address the full range of issues in their applications and take full advantage of the pre-application planning process established by legislation in 2007. The applying utility should make complete information available to the public about the need for the line, includ-

ing options for not building the line, and for possible routes. This will narrow the issues to be considered by the SCC and increase the likelihood of completing the permit review within the twelve-month limit of federal law.

While Virginia recognizes that electric supply issues cross state lines and require assessment across a multistate region, decisions regarding the routing of these lines should continue to be made at the state level.

If an NIETC designation is made in Virginia, the prohibition against use of federal eminent domain over state property must include a prohibition against use of federal eminent domain to overturn state-owned conservation easements.

Studies of the capacity of the electric transmission system in Virginia are undertaken as part of the PJM adequacy planning process. This process is designed to include participation from multiple stakeholders, including electric utilities, consumers, public interest groups, states, and localities. The SCC and the Consumer Assistance Division of the Office of the Attorney General represent Virginia state government in the process. PJM has identified the need for greater involvement of executive branch officials in the process. Virginia should develop a better coordinated approach among the SCC, Office of the Attorney General, and the executive branch energy policy and environmental agencies to provide state input into PJM's and the North American Electric Reliability Council's planning processes. The level of coordination or communication among the SCC, Office of the Attorney General and Governor's Office should recognize that the SCC's role may be limited by the need to avoid pre-judging matters that may come before the SCC for approval. This might limit the level of coordination possible with the SCC on some matters.

PJM has the responsibility to ensure that adequate electric supplies are available to meet future electric needs. PJM only counts conservation and demand-control activities that are under binding contract

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to utilities in the region when assessing future loads. PJM should include the effects of a broad portfolio of conservation and demand-control programs. This should reduce the risk that the load will still be on-line during peak times. Further research should be undertaken to determine an acceptable capacity factor to use for conservation and demand-control programs.

There is ongoing debate whether new electric transmission lines should be constructed on overhead towers or placed underground. The Commonwealth, through the Joint Commission on Technology and Science, is evaluating issues regarding aboveground versus underground placement of transmission lines. Virginia should continue its evaluation of the costs and benefits of placing electric transmission lines underground in order to generate accurate information needed to determine when the costs of placing lines underground make such construction in the public interest.

7.2.2 Renewable Electric Generation

Virginia enacted a voluntary renewable portfolio standard in its 2007 electric utility regulation legislation. This calls for Virginia's participating investor-owned electric utilities to generate 4 percent or more of their electricity from renewable sources by 2012, 7 percent or more by 2017, and 12 percent or more by 2022. Meeting this would require generation of over 7.75 million megawatt-hours of power from renewable sources. Existing renewable generation will be able to meet approximately 2 percent of this load. Both Dominion Virginia Power and Appalachian Power are working on plans to develop new renewable-power generation from wind and other sources to meet these goals.

Biomass-fired electric generation should not compete with the lumber and wood products industry for wood fiber. These industries provide a higher value product from Virginia's forests. Virginia should

develop the supply systems needed to make wood remaining after commercial lumber harvesting, land-clearing debris, and demolition waste available as a fuel for biomass-fired electric generation plants.

Virginia Tech, working with the Department of Forestry, has a GIS mapping tool to identify locations of wood resources. This tool should be expanded to include all potential sources of biomass for energy generation.

Property owners can integrate small-scale electrical generation into their homes and buildings. Some community associations and localities place limits on installation of energy-generating property. Property owners should not face unreasonable limits to add renewable power sources. For example, community associations should not place unreasonable restrictions on installation of solar thermal or photovoltaic panels that are integrated into the facility design. Community associations and localities are encouraged to use the state system to rate a property's suitability for solar and wind development when considering approval of such uses. Additional localities should exercise their authority to exempt solar systems from property taxes to eliminate any property-tax penalty from system installations.

There has been considerable debate about the appropriateness of onshore wind development in Virginia and other states. Onshore wind development should be approved upon local land-use acceptance and a finding of no significant mortality of avian and bat species. Early projects should include post-construction monitoring to identify avian and bat impact. Localities should consider both the potential value to increasing electric supply diversity in their areas and the potential visual and community effects of proposed projects.

The General Assembly authorized two grant programs in 2006 to support development of alternate energy supplies. The programs have not been funded, however. The Renewable Electricity Production Grant Program was designed to support

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generation of electric power from renewable sources. Large-scale renewable electricity production now will be supported through implementation of the state's renewable portfolio standard. Small generators would be supported through the Photovoltaic, Solar, and Wind Energy Utilization Grant Program. These small generators would not receive support under the renewable portfolio standard. Therefore, the Commonwealth should first, to the extent resources are available, provide financial support to the Photovoltaic, Solar, and Wind Energy Utilization Grant Program before funding the Renewable Electricity Production Grant Program.

It is the state's policy to support federal efforts that examine the feasibility of offshore wind energy being used in an environmentally responsible fashion. Initial reviews find that Virginia has substantial potential for development of offshore wind resources beyond the normally visible horizon. The Commonwealth should encourage all cost-effective, environmentally responsible development of its offshore wind resources. Virginia should work with the federal Minerals Management Service's Outer Continental Shelf Alternate Energy and Alternate Use Program to more carefully characterize the offshore wind potential and identify potential environmental impacts of such development.

Virginia will continue to need new and upgraded electric distribution systems. This will require an ongoing investment by Virginia's electric utilities to meet growing system needs and ensure reliability of supply.

7.2.3 Natural Gas Infrastructure

Virginia's natural gas infrastructure supports a wide array of natural gas users. While the natural gas infrastructure has generally been adequate to serve these users, there have been transmission constraints to south Hampton Roads. The planned third pipeline crossing of the James River should help reduce this problem. State, regional, and local

economic development officials should monitor the supply and demand for natural gas and work with the local natural gas utilities, pipeline companies, and the State Corporation Commission to ensure that an adequate supply infrastructure is maintained.

Virginia's natural gas is supplied through three primary routes: natural gas pipelines from the Gulf of Mexico region, natural gas imported through the Cove Point, Maryland, liquefied natural gas (LNG) terminal, and natural gas produced in southwest Virginia's natural gas fields. Because of pipeline system limits, the Cove Point imports serve primarily the northern Virginia and Virginia peninsula regions and the southwest Virginia gas fields serve primarily southwest Virginia markets.

Virginia remains largely dependent on supplies from the Gulf of Mexico region. As seen in 2005, disruption of supplies from this region causes substantial price increases to Virginia consumers and exacerbates the price differential paid by Virginia consumers compared with most other regions of the country. Virginia should carefully consider projects to diversify its natural gas supplies, such as new LNG terminal construction or increased pipeline capacity from southwest Virginia's natural gas fields to eastern Virginia. Such projects should be protective of public safety and high-value environmental resources.

Developing new sources of supply will require new investments. Virginia needs to carefully consider how its regulatory structure and rates affect companies' access to low-cost capital needed for these investments.

One potential source to diversify Virginia's natural gas supplies is from offshore natural gas production. Any development of offshore natural gas should be made consistent with Virginia policy. Both the federal Mineral Management Service (MMS), through its leasing actions, and the National Oceanographic and Atmospheric Administration, through Coastal Zone Management program

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approvals, should recognize Virginia policy when taking action affecting offshore development. The MMS also should work together with the offshore exploration and production industry and East Coast states to determine the extent of offshore natural gas resources and the environmental protections that would be needed if such development were to proceed.

The MMS established state administrative boundaries in outer continental shelf waters using an equidistance methodology for the purpose of managing offshore resources. The equidistance methodology expands the areas attributable to states with convex coastlines and decreases the areas attributable to states, such as Virginia, with concave-shaped coastlines. Use of equidistant boundaries reduces the Commonwealth's ability to influence decisions about offshore resource development. This will affect not only natural gas extraction but also sand, other minerals, and renewable energy resources. The MMS should revise the administrative boundaries to more equitably reflect coastal states' interests.

7.2.4 Petroleum Infrastructure

Virginia consumers receive gasoline, diesel fuel, fuel oils, and aviation fuel from three primary sources: two petroleum-product pipelines from the Gulf of Mexico region, the oil refinery in Yorktown, and by ship and barge delivered to terminals on Virginia's east coast.

Virginia made permanent the sales-tax exemption to supplies and equipment for the Yorktown refinery to help the refinery owner obtain financing for an expansion project. State and regional economic development entities should continue to work with the refinery owner to provide all cost-justified assistance to this expansion.

Gasoline, diesel, and other petroleum products are distributed through a network of terminals located in and around Virginia. As the marketplace for petroleum products expands to include new products such as low-sulfur fuels,

ethanol, and biodiesel, petroleum terminals must reconfigure their facilities to manage the new products. Local governments should, consistent with public health and safety protection, streamline approval of modification plans and provide flexibility to terminal operators to make these needed changes.

Development of alternate fuels such as ethanol and biodiesel will require development of new fuel production and transportation facilities. Other infrastructure will be needed to supply raw-material inputs, such as biomass supplies, to production facilities. Virginia's production incentive for in-state-produced biofuels should be funded to provide sufficient incentive for producers to locate new plants in Virginia. Localities are encouraged to work with state economic development, agriculture, and energy agencies to identify sites that provide the necessary infrastructure for new biofuel production facilities.

Virginia has substantial municipal solid waste and agriculture waste that could be a feedstock to alternate fuel production. Virginia should provide incentives to increase the use of municipal solid waste or agricultural waste for energy generation or alternative liquid transportation fuels.

The U.S. military has set goals to replace petroleum fuels with alternates. Virginia should target the military ground transportation and ship transportation systems as a market for in-state-produced synthetic diesel fuels.

7.2.5 Coal Production Infrastructure

The Commonwealth and Virginia's coal industry should work together to maintain a viable mining industry. Virginia's coal industry is the backbone of the economy in southwest Virginia and provides needed coal resources for electric and steel production at reasonable costs to consumers. The state and industry should continue efforts to provide safe working conditions for mine workers, including working to implement provisions of changes in federal mine safety law related

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to mine rescue, emergency supplies in mines, underground miner tracking and communication systems, and seals used in underground mines. The state and industry should also continue work to control deleterious effects of coal mining on the environment and neighboring communities.

Virginia relies on railroad and highway infrastructure for transportation of its coal resources. Coal-related road and rail infrastructure are generally adequate. Local governments in southwest Virginia should use local coalfield road improvement funds to ensure that there are adequate roads to haul coal on routes that minimize conflict with built-up areas. Virginia's rail providers must ensure that adequate rail-car capacity remains available to carry coal from Virginia's mines to end users and export facilities.

Virginia will need to invest in new infrastructure to support carbon capture and storage in unminable coal seams. Virginia is positioned to be a leader in developing this technology. Investments are needed in facilities to collect carbon from generating sources, transport it to the areas with available coal seams, and inject it into the unminable coal seams. Additional investment is needed in the research facilities needed to develop this technology. This research could be housed in a Fossil Fuel and Carbon Management Center operated by the Virginia Center for Coal and Energy Research in Abington and Dickenson County.

Virginia has the opportunity to import coal from sources such as South America to provide the lowest-possible-cost coal to utility and industrial users. While Virginia should not take actions that would diminish the viability of southwest Virginia coal producers, Virginia coal consumers will benefit from the market diversity provided from coal imports. Therefore, Virginia should provide necessary approvals needed to modify existing coal export facilities to accept coal imports.

7.2.6 Hydrogen Industry Infrastructure Development

Hydrogen may meet increasing amounts of Virginia's energy needs over the next ten years. As provided for in Virginia's hydrogen blueprint, the state should support development of fueling infrastructure as the market develops for hydrogen fuel use.

7.2.7 Energy Infrastructure Security

Virginia's energy industry must take necessary steps to protect the state's energy infrastructure from natural and human-made disasters. This includes performing ongoing maintenance of facilities and rights-of-way, updating controls and infrastructure to replace aging equipment and facilities, and hardening existing facilities where needed for protection. Particular emphasis should be placed on central facilities such as power plants, bulk fuel storage facilities, and transmission infrastructure.

State, local, and federal public safety and homeland security agencies should maintain clear communication with energy providers to plan for, test response plans for, and ensure coordinated response to any risks or incidents.

Virginia's emergency response facilities must have energy to operate during and after natural or human-made disasters. Virginia and its localities should ensure that their emergency operations centers have adequate emergency electric generation backup. Fuel supply contracts for emergency generators and emergency response vehicles should require delivery of alternate sources if primary sources are unavailable because of emergency. Renewable energy sources, such as solar photovoltaic systems, can be used to provide localized electric service at locations, such as gas stations, to maintain essential services after a disaster.

7.3 Energy, the Environment, and Climate Change

Decisions on how Virginia will meet its future energy needs should be based on analysis of both costs of the energy sources and the need to protect ecosystems, natural resources, and the health and well-being of citizens, including economically disadvantaged and minority communities.

Energy consumption is the largest contributor to greenhouse gas emissions. The Intergovernmental Panel on Climate Change's (IPCC's) *Fourth Assessment Report* stated, with an increased confidence level over previous reports, that most of the observed increase in globally averaged temperatures since the mid-twentieth century is "very likely due" to the increased anthropogenic greenhouse gas concentrations. The third IPCC report had labeled increased temperature "likely" due to increased greenhouse gas concentrations.

Carbon dioxide emissions rose in Virginia by approximately 34 percent from 1990 to 2004, a rate nearly twice the national average. This increase results, in part, from growth in Virginia's economy and development patterns that have produced sprawl and long commutes. Vehicle ownership rates also increased during this period, in which Virginia ranked in the top ten states with a 30 percent increase in gasoline-powered cars.

What does climate change mean for Virginia? Over the long term, climate change will affect Virginia's population, wildlife, and economy. The Virginia Institute for Marine Science estimates that the Mid-Atlantic sea level will rise between 4 and 12 inches by 2030, threatening coastal islands and low-lying areas. Air and sea temperature changes would cause more frequent tropical storms, with increased damage to Virginia coastal communities. Chesapeake Bay is particularly susceptible to damage caused by increasing ocean levels due to climate change. There would also be increased flooding to inland communities from

more intensive storms caused by climate change. Changing rain and temperature patterns would disrupt agriculture and forestry.

To meet the challenges of climate change, Virginia should reduce carbon emissions by 30 percent by 2025, to return to its year 2000 greenhouse gas emission level.

Carbon dioxide emissions can be reduced by energy efficiency and conservation, using energy from sources that generate less carbon dioxide or are part of a closed carbon cycle, and carbon capture and storage. Methane emissions can be reduced by maximizing production of coalbed methane related to coal mining, improving gathering, transmission, and distribution pipeline systems to eliminate leaks, and by increasing waste-to-energy development and landfill gas recovery. Meeting the 10 percent electricity conservation goal and the 12 percent renewable portfolio standard goal for Virginia's investor-owned utilities in the 2007 electric regulation legislation, and achieving a 10 percent reduction in gasoline use in Virginia, would reduce carbon dioxide emissions by nearly 18 million tons per year, or approximately 15 percent of Virginia's total 2005 carbon emissions.

While energy-efficiency actions will help reduce carbon emissions, other actions will be needed if Virginia is to meet the 30 percent reduction goal. Insufficient information is available to determine how to meet the full 30 percent goal. Therefore, Virginia should create a Commission on Climate Change to make a more comprehensive assessment of greenhouse gas issues and develop a plan for how to reach a greenhouse gas emission reduction goal.

Specifically, the Commission would be charged with preparing a Climate Change Action Plan that would (i) calculate the size of and contributors to Virginia's carbon footprint, (ii) address the effects of increasing atmospheric greenhouse gas concentrations on the state, (iii) identify what Virginia needs to do to prepare for the likely consequences of climate change,

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and (iv) identify what actions are needed to meet goals for reducing greenhouse gas emissions.

To help this effort, Virginia should go beyond a voluntary reporting regime and require reporting of greenhouse gas emissions using The Climate Registry protocol. This will provide the necessary data to calculate the size of Virginia's carbon footprint and allow the Commonwealth to better assess what steps are needed to reduce greenhouse gas emissions.

This issue should be the subject of national policy because both the causes of, and solutions to, climate change transcend state and local boundaries. But, the magnitude of the problem is such that states can not simply wait for a federal resolution. It is hoped that these recommendations, and similar actions taken by other states and localities, may motivate a comprehensive national approach to this topic. Virginia stands willing to participate in the develop of such an approach and will work to harmonize our efforts with a reasonably aggressive national strategy.

Greenfield development, besides using open space and changing the environment at the site, promotes increased energy use. Development should be clustered and infill and brownfield development should be encouraged to reduce energy impacts. Government policies should be put in place to encourage development that allows for greater use of transportation, requires less new energy infrastructure, and provides for greater energy efficiency in the built environment.

Renewable energy production that offsets conventional energy production should be promoted to reduce environmental emissions. Carbon capture and storage should be further developed to reduce the carbon emissions from conventional energy production.

Environmental programs should be leveraged to increase energy efficiency and renewable energy development, such as using renewable energy purchases to offset nitrous oxide emissions under

Virginia's ozone State Implementation Plan. Consumer education should identify the co-environmental and energy effects of wise resource management. Virginia governments, businesses, and individuals should be encouraged to participate in activities under programs such as Clean Cities, Cool Cities, Cool Counties, Climate Leaders, and the Virginia Environmental Excellence Program.

As energy is consumed economy-wide, actions to control carbon emissions should take an economy-wide approach. Reducing energy use through efficiency and conservation improvements, constructing more efficient new buildings, improving industrial process energy efficiency, reducing vehicle miles traveled, and increasing vehicle fuel economy, as well as increasing use of carbon-neutral fuels, should all be used to reduce greenhouse gas emissions.

7.4 Energy R&D

Virginia has a strong foundation of energy research and development (R&D). The state's universities and businesses have leading research activities in areas such as biofuels, fuel processing, nuclear level physics, carbon capture and storage, wind, and coastal energy resources. Numerous small businesses, often spun off from university and federal laboratory research, are involved in energy R&D. However, there are weaknesses in coordination among research activities and in making consistent funding available for matching federal R&D funding and for multiyear research efforts.

Energy R&D in Virginia should be strengthened by providing a consistent funding source and using a governance system involving university, business, and government stakeholders to set energy R&D priorities. This governance system should set out a roadmap identifying the growth areas for energy R&D, the areas where Virginia researchers can bring added value to these growth areas, and recommend projects for state support. Based on analysis completed for this Plan, Virginia has strategic opportunities for

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energy R&D related to nuclear power development, cellulosic and waste-based biofuels, coastal energy, and carbon capture and storage in unminable coal seams.

This energy R&D governance system should be established as a virtual organization, named the Virginia Energy Research and Development Organization (VERDO). VERDO should join the Association of State Energy Research and Technology Transfer Institutions (ASERTTI).

The energy R&D fund should be available to match federal energy R&D projects, provide funding to build state energy R&D capacity, and provide funding for reduction to practice projects that help new technologies bridge the "valley of death" between research and commercialization. Organizations receiving funding should be required to provide internal funds to their projects. This is often referred to as "having skin in the game."

VERDO should host energy research showcases to bridge technologies developed by Virginia's energy R&D organizations to the venture capital and businesses with the resources to bring the ideas to commercialization. This could be done solely in Virginia but might be more effective if undertaken jointly with neighboring states to become a Mid-Atlantic energy R&D showcase.

Virginia should support development of two or three energy technology parks. Each park should have one or more key energy tenants to anchor it, with room for energy start-ups and research facilities. The energy technology parks could be centered around a particular technology such as biofuels, wind technologies, coal, or natural gas exploration and production.

7.5 Energy Economic Development

Energy businesses can add to Virginia's economic vitality. Today, coal and natural gas production provide the foundation for southwest Virginia's economy. Virginia's

cost-competitive energy supplies provide a natural advantage to business recruitment and retention. Renewable energy supplies provide an opportunity for new job growth across the state. There are particularly good opportunities for new alternate liquid fuel-based job growth.

Virginia should target its business development actions to those energy businesses that produce employment and capital investment gains. Energy investments should be evaluated for their return on investment to Virginia and its localities.

Virginia should refine its production grants for renewable energy businesses, such as those for solar manufacturers and biofuel producers, to ensure that the support meets business needs while providing a positive return on investment to the Commonwealth. Virginia should consider combining economic development incentives with other actions that would help develop markets for the alternate energy businesses. This should include assistance needed to take advantage of the U.S. Department of Energy's clean energy loan guarantee and similar programs. Up to \$5 million per year is needed to fund these incentives and support other new energy business development.

Virginia should form a multiagency Tiger Team of state agency energy and economic development specialists to work with localities and industry partners to identify and package appropriate energy project sites.

Virginia should increase support for energy research partnerships between its universities and businesses. This is further spelled out in Chapter 6 and in Section 7.3 above.

Economic developers should work with the state's electric utilities and the State Corporation Commission to use existing authority and offer an economic development electricity package as part of the state's incentive package for major energy-intensive projects. Virginia's electric rates historically have been very competitive compared with those in other states, especially those with whom we normally

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compete. Virginia should work with its electric utilities to create a not-to-exceed price structure for energy-intensive companies with greater than a 20-megawatt load and who have a high capital investment and high electrical load factor. The rate should only be available after energy-conserving measures have been implemented so that the industry would be among the most efficient in its class. The economic development rate should be based on an analysis showing that the new industry's load profile, cost of service, and proposed rate would not lead to cross-subsidization from other customers. This would not only provide an incentive for large-scale industrial development but would increase the market for energy technology companies offering energy-efficiency services to Virginia's manufacturers.

Virginia should increase activities to further develop the state's nuclear industry cluster. The Lynchburg area offers unique opportunities, being home to Areva NP and BXWT, companies that design, service, and build nuclear components for the civil and military markets. This, coupled with the Norfolk Naval Base and Northrop Grumman Newport News Shipbuilding in Hampton Roads and closeness to Washington, D.C., with its nuclear regulatory bodies, provides Virginia with a strategic advantage. Virginia should help provide this industry with trained labor needed to fill its highly technical jobs through providing long-term financial support to the Center for Advanced Engineering and Research in Lynchburg. This work is particularly timely during the term of this Plan as the nuclear industry will be growing to respond to the upcoming market cycle for new nuclear generating plants.

Virginia should assess the business opportunities that will come from decommissioning nuclear Navy ships and support development of businesses needed to provide these services. Virginia's existing nuclear business infrastructure is well positioned to take a lead in this upcoming market.

Virginia should assess the potential value of and regulatory needs for uranium production in Pittsylvania County.

Virginia should support development of new energy technology business parks. As discussed above in Section 7.3, energy technology parks could have one or more key energy tenants to anchor them, with room for energy start-ups and research facilities. These parks could be centered around a particular technology, and they should be located where high-quality rail and utility service could be provided to tenants. Funds from sources such as the Tobacco Revitalization Commission or Virginia Coalfields Economic Development Authority can be used to provide the needed infrastructure for such parks in Southside or Southwest Virginia. One target market for a plant could be alternate liquid fuels produced for military ground and ship transportation. A second high-value center for Virginia might be a fossil-fuel and carbon management center located in Southwest Virginia.

Virginia should provide workforce services that support development of adequate numbers of trained workers for energy businesses. Virginia's community colleges and economic development officials should work with industries in their area to provide region-specific training programs for energy industry clusters. Examples include coal miner training provided by Southwest Virginia and Mountain Empire Community Colleges and industry-specific training provided through the Center for Advanced Engineering and Research in Lynchburg. Efforts to develop vocational training curricula should account for regional needs of energy providers. An example of such a program is the Kentucky Coal Academy's curriculum provided to coal-field high schools in Kentucky.

Virginia should, when assessing whether projects impose a disproportionately adverse impact on economically disadvantaged or minority communities, address both the potential for negative environmental impacts and positive economic value.

7.6 Implementing the Recommendations

Many of the recommendations of this Plan will require financial support to implement. Financial support is needed to overcome barriers faced by individual consumers and businesses in making cost-effective investments in energy efficiency, infrastructure, new energy supplies, new business development, and research, development, and deployment. Virginia can attract additional federal funds through providing non-federal cost-sharing. Virginia also can attract additional private investment in energy projects through state support. New public education activities will require new financial support.

Virginia has not been able to attract some energy investments because of a lack of funds to support new projects. In two recent examples, Virginia unsuccessfully proposed to host the National Energy Technology Laboratory's new offshore wind turbine blade test facility. Virginia's proposal was ranked below those from Massachusetts and Texas primarily because it included less financial support. Virginia also had limited ability to compete for the U.S. Department of Energy's (DOE's) Bioenergy Research Centers.

There will be ongoing opportunities for Virginia to compete for new federal funding for energy activities. For example, the U.S. DOE is proposing to fund additional carbon capture and storage projects. Virginia is positioned to develop a coal-seam carbon capture and storage project if it can develop a technology and cost-competitive project. The U.S. DOE continues to fund biofuels development research, development, and deployment activities. Virginia universities have the research experience and can compete for these resources given a source of non-federal funds to match grants.

Tax benefits are an effective means to overcome barriers to private investment in energy-conservation and development activities. Tax credits, tax holidays, and accelerated depreciation can be used to

raise awareness of and provide financial support for energy investments. Virginia is implementing a sales-tax holiday for certain Energy Star-rated appliances and equipment. Virginia should monitor this sales-tax holiday to better understand the revenue impact of this action. This data can be used to estimate the revenue impact of any expansion of the sales-tax holiday.

The federal government provides income-tax credits and accelerated depreciation for private investments in energy production and energy efficiency. Virginia could consider providing state tax treatment for energy-efficiency investments similar to federal tax benefits to provide additional incentives for energy-conservation activities.

Direct incentives in energy conservation and alternative energy development are necessary to overcome barriers to investment in these areas. To be effective, funding should be reliably available over a multiyear period. Short-term or start-and-stop investments lead to inefficient management of activities.

As discussed above under the individual recommendations, achieving the goals of this Plan will require substantial new annual investments by the Commonwealth, private business, and individuals. Estimated costs of these initiatives are summarized below.

- If Virginia is to meet its 10 percent electric savings goal by 2022, the Commonwealth's electric utilities will need to invest in the range of \$100 to \$120 million per year to support energy-conservation programs. This would include costs of incentives, consumer education, and administration of energy-efficiency and conservation programs. Utility consumers would have to match this investment with \$180 to \$200 million per year to cover their share of up-front energy-efficiency costs.
- \$5 million per year is needed for energy R&D to foster long-term improvements to how Virginia and the nation can supply and use energy more efficiently. This should be matched with at least an equivalent

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amount from private and federal sources.

- Renewable energy grant programs established in the 2006 legislation and other efforts to expand use of renewable energy sources should be funded \$5 million per year if we are to achieve a significant growth in renewable energy supplies.
- Up to \$5 million per year is needed to support energy businesses incentives, such as the Biofuels Incentive Grant Program, and for new technologies such as waste, cellulosic, and coal-based liquid fuel production, solar panel and wind turbine manufacturing, and development of innovative energy sources and infrastructure such as combined heat and power projects and ethanol fueling stations.
- \$2 million per year is needed to expand the number of elderly and low-income families served through the Weatherization Assistance Program.
- \$1 million per year is needed for energy education to supplement utility-based consumer-education programs and other smaller-scale energy projects.

The Governor's Energy Policy Advisory Council, with assistance from the Department of Mines, Minerals and Energy and other agencies, should be charged with evaluating the energy saved, new supplies of energy generated, and value of investments in energy R&D and new business development resulting from this Plan. The results of the evaluation would be reported back to the Governor and the General Assembly to ensure accountability of the proposed energy activities.

Taken together, these recommendations will result in a substantial investment in new energy activities in Virginia. By heeding these calls to action, government, individual citizens, and businesses will use energy more wisely, have increased security from energy-driven disruptions, and help ensure the availability of needed energy supplies to support the state's economy and reduce the future impacts of climate change.